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EXAMINER	
DSOUZA, JOSEPH FRANCIS A	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/612,976	WU ET AL.	
	Examiner	Art Unit	
	Adolf DSouza	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 08 May 2007.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1 - 49 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1 - 49 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Response to Arguments

1. Changes to the drawings, specification and claims have been accepted by the Examiner.

2. Changes to claim 5, in response to the 35 USC 112/ 1st paragraph rejection have been accepted by the Examiner.

3. Applicant's arguments, see Remarks (5/8/2007, page 21, 1st 3 lines; page 22, 1st 6 lines; page 23, 2nd paragraph, last 2 lines "...antenna elements 401 are not equivalent to N transmit ...";) with respect to the rejection(s) of claim(s) 1,6,7,and 48 under 35 USC 102(b) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Lundby et al. (US 6,356,528).

4. Applicant's following arguments filed Remarks (5/8/2007) have been fully considered but they are not persuasive.

- Argument: Applicant has argued that there is only one respective main signal is transmitted by each antenna (Remarks, page 24, 24, 2nd paragraph, last line "...only one respective main signal is transmitted by each antenna").

  Response: Feuerstein discloses in Fig. 6 that each beam has all main signals fed to it. These main signals are weighted by the switch matrices 651, 652 etc. For example, in beam 1, one of ordinary skill in the art can easily select only the main signal 601 by setting the weights for all other main signals to be zero. Each beam

signal can be fed to the appropriate antenna in Lundby' system. Therefore, Examiner argues that each antenna signal has only one main signal.

- Argument: Applicant has argued that the signal are transmitted to a common receiver (Remarks, page 25, 1st 3 lines0>

  Response: As described in paragraph (3) above, Examiner is using Lundby for multiple transmit antennas. In Lundby' system, the multiple transmit antennas transmit to a common receiver (Fig. 1). The signal delaying and weighting can be done using Feuerstein method and the beam signals fed to the transmit antennas of Lundby.

- Argument: Applicant has argued that amended claim 6 discloses a first linear combination and a second linear combination (Remarks, page 25, line 6 – 11 from top of page).

  Response: Feuerstein' s method of combining the main and delayed signals (Fig. 2) is very general. By selecting the appropriate weights in the switch matrix, any linear combination desired can be obtained.

- Argument: Applicant has argued that Feuerstein teaches away from the invention (Remarks, page 26, 2nd paragraph, last 6 lines).

  Response: One of ordinary skill in the art can easily use Feuerstein' s weighting method to obtain the beams 1, 2, ... and then feed those to the multiple antennas

in Lundby' system. Examiner is now using Lundby only for delaying and weighting the different main signals. One this is done the can be fed to the multiple antennas of Lundby instead of the antenna elements of Feuerstein.

- Argument: Applicant has argued Lundby does not disclose the N transmit signals collectively contain a plurality of N main signals and a plurality of delayed main signals (Remarks, page 27, 1st paragraph and last paragraph; page 28, 2nd last paragraph).

  Response: Examiner respectfully disagrees. As described, above when the beams generated by Feuerstein's method of delaying and weighting the main signals are fed to the multiple antennas of Lundby, the N transmit signal will collectively have all the main signals and all the delayed signal.

- Argument: Applicant has stated that there does not seem to be a rejection of claim 23 in the Office Action (Remarks, page 28, 3rd paragraph, 3rd line).

  Response: The rejection appears on page 16, middle of page. Examiner forgot to include the claim number in paragraph (10) on page 15.

- Argument: Applicant has stated that Brunner does not disclose a sample selector (remarks, page 29, 3rd paragraph).

  Response: Examiner is now using Hilton (which was previously used for claims 29 and 30) to show that the input stream is sampled using two ADC, which are

phase shifted, to give the odd and even streams (Fig. 3, elements 320, 330,340, 350). Fig. 2 of Hilton is another way of obtaining the same result. Here, only 1 ADC is used and the sample selector can be interpreted as the element 240, which gives the even and odd streams.

- Argument: Applicant has stated that Lundby discloses an FEC decoder that receives a single input stream (Remarks, page 29, last paragraph – page 30, 1st paragraph).

  Response: Examiner has done a 35 USC / 1st paragraph rejection claim 26 since the MIMO decoder is not described in detail in the specification. The MIMO decoder 250 shown in Applicant's Fig.1 2 has 2 inputs and 1 output. So obviously, the two input streams are combined within the decoder in some way to obtained one output stream. The details of this are not disclosed. Possibly, one could combine the two streams first, as shown by Lundby and then use the decoder. Examiner is also introducing another reference (Rudrapatna et al; EP 1313246A1) that uses a MIMO decoder in a multiple antenna system.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claim 26 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

See response to Arguments (last bullet) above.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1, 6, 7, 10, 11, 13, 31, 32, 36, 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528).

Regarding claim 1, Feuerstein discloses a transmitter (Fig. 6; column 1, lines 25 - 29) comprising:

the N transmit signals collectively comprise a plurality N of main signals (Fig. 6, elements α , β , γ) and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals (Fig. 6, outputs of elements 621, 622, 623; column 7, lines 15 – 40; wherein the delayed signals are the outputs of the delay elements 621, 622, 623 that are fed to elements 651, 652, 662 to produce the beams 1, 2 ..12), wherein each transmit signal comprises a combination of only a respective main signal of the plurality of N main signals and at least one respective delayed main signal of the plurality of delayed main signals (Fig. 6, elements 651, 652, 662 outputs; column 7, lines 1 - 56, wherein the outputs are obtained by combining the main signal with the delayed signals, the combination being provided by the switch matrices whose weights can be adjusted to give only one main signal per beam).

Feuerstein does not disclose N transmit antennas where N>=2.

In the same field of endeavor, however, Lundby discloses N transmit antennas (N >=2) with each transmit antenna for transmitting a respective one of N transmit signals to a common receiver (Fig. 1).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

Regarding claim 6, Feuerstein discloses:

a first delay element for delaying the first main signal $S_A(t)$ to produce a first delayed signal S_A (t-D1) where D1 is a first delay (Fig. 6, element 621; column 7, lines 15 – 26; wherein the delay is element 621);

a second delay element for delaying the second main signal S_B (t) to produce a second delayed signal S_B (t-D2) where D2 is a second delay (Fig. 6, element 622; column 7, lines 15 – 26; wherein the delay is element 622);

wherein a first linear combination of one of the main signals and one of the delayed signals is transmitted and a second linear combination of the other of the main signals and the other of the delayed signals is transmitted (Fig. 6, outputs of elements 651, 652; column 7, lines 15 – 55; wherein the first and second linear combinations are provided by the switch matrices 651 and 652 which can be programmed by the controller 670 to provide the desired linear combination and then these beams are fed to Lundby' 1stand 2nd antennas).

In the same field of endeavor; however, Lundby discloses a transmitter for transmitting a first main signal SA(t) and a second main signal SB(t) (Fig. 2, signals in upper and lower paths), the transmitter comprising:

a first antenna and a second antenna (Fig. 2, elements 4, 6; column 7, lines 26 – 44).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of

Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

Regarding claim 7, Feuerstein discloses the first main signal and the second main signal are each CDMA (Code Division Multiple Access) signals (Title; Abstract; column 12, lines 19 – 22).

Regarding claim 10, Feuerstein does not disclose scrambling the first and second main signals.

In the same field of endeavor, however, Lundby discloses a scrambling circuit for scrambling a first signal to produce the first main signal and for scrambling a second signal to produce the second main signal, the first signal and the second signal being scrambled with an identical scrambling code (Fig. 2, elements 116, 118; column 6, lines 15 – 20; column 7, lines 18 – 21; wherein the scrambling circuits are the PN circuits 116 and 118. Lundby does not explicitly state what the spreading codes are and therefore Examiner has taken the broadest interpretation and assumed that they could be equal or different. In column 7, lines 26 – 44, Lundby states that the signals in the path could be distinguished from each other by using the delay element. Therefore, using the same PN in each path would not prevent the receiver from distinguishing the two paths).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of

Feuerstein because this would allow the signal in the two channels to be distinguished from each other, as disclosed by Lundby.

Claim 11 is similarly analyzed as claim 10.

Regarding claim 13, Feuerstein does not disclose a demultiplexer for splitting the symbols into two streams.

In the same field of endeavor, however, Lundby discloses a demultiplexer for splitting a symbol stream into symbols included in said first signal and said second signal (Fig. 2, element 104; column 5, line 66 – column 6, line 3).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the signal to be transmitted by multiple antennas, as disclosed by Lundby (Fig. 2).

Regarding claim 31, Feuerstein discloses the transmitter (Fig. 6).

Feuerstein does not disclose a receiver and atleast one receive antenna.

In the same field of endeavor, however, Lundby discloses a receiver comprising at least one receive antenna (Fig. 3, element 200), each receive antenna receiving a respective receive signal over the wireless channel from the transmitter (Fig. 3, element 200) receive signal processing circuitry adapted to process the receive signals (Fig. 3, element 207 - 224).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the signal to be received, processed and decoded, as is well known in the art.

Claim 32 is similarly analyzed as clam 31 with the searcher in the receiver capable of detecting the main signal and the delayed signals.

Regarding claim 36, Feuerstein discloses a transmitter (Fig. 6);

a first delay element for delaying the first main signal $S_A(t)$ to produce a first delayed signal S_A (t-D1) where D1 is a first delay (Fig. 6, element 621; column 7, lines 15 – 26; wherein the delay is element 621);

a second delay element for delaying the second main signal S_B (t) to produce a second delayed signal S_B (t-D2) where D2 is a second delay (Fig. 6, element 622; column 7, lines 15 – 26; wherein the delay is element 622);

wherein a first linear combination of one of the main signals and one of the delayed signals is transmitted and a second linear combination of the other of the main signals and the other of the delayed signals is transmitted (Fig. 6, outputs of elements 651, 652; column 7, lines 15 – 55; wherein the first and second linear combinations are provided by the switch matrices 651 and 652 which can be programmed by the controller 670 to provide the desired linear combination).

The limitation regarding the first main signal, second main signal, first antenna and second antenna is as analyzed in claim 6 above.

Claim 48 is similarly analyzed as the corresponding limitation in claim 1.

9. Claims 2, 3, 33, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Harrison (US 6.067,324) and Alamouiti (A Simple Transmit Diversity Technique for Wireless Communications; October 1988; IEEE Journal on Select Areas in Communications; pages 1451 – 158).

Regarding claim 2, Feuerstein discloses Transmit_J comprises:

$$Transmit_J = (S_J) + \sum_{i=1}^{K_J} (S_U(i - D_U))$$

S_J=is the J^{th} main signal of the plurality of main signals;

α_J = is a virtual spatial reflector applied to the J^{th} main signal;

T_J = is a transformation applied to the J^{th} main signal;

K_J = is a number of delayed signals included in the J^{th} transmit signal;

α_{iJ} = is a virtual spatial reflector applied to the i^{th} delayed signal included in the J^{th} transmit signal;

S_{iJ} , i=1, . . . , K_J are the signals which are to be delayed and included in the J^{th} transmit signal where each iJ $\in$ 1, . . . , N;

D_{iJ} = is a delay applied to signal S_{iJ};

T_{iJ} = is a transformation applied to the i^{th} delayed signal included in the J^{th} transmit signal.

(Fig. 6, column 7, lines 1 – 56; wherein for example if J = 1, then the signal S_1 would be the main signal in beam 1 which is the α signal and the delayed signals would be the signals βD and γD. The switch matrix can be set to select the appropriate signals that comprise each beam).

Feuerstein does not disclose that the signals are transmitted from one of multiple antennas, main and delayed signals are scaled and a transformation.

In the same field of endeavor, however, Lundby discloses the N transmit signals comprise a J^{th} transmit signal $Transmit_J$ from antenna J=1, . . . , N, (Fig. 2, element 4, 6).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of

Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

In the same field of endeavor, however, Harrison discloses a gain scaling that can be applied to each path (Fig. 5, element 306; column 6, lines 44 – 48).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Harrison, in the system of Feuerstein because this would allow the spectrum to be shaped, as is well known to one of ordinary skill in the art or also control the transmitted power, as disclosed by Harrison (column 3, lines 45 – 47).

It is noted that the applicant has stated that an example of the transformation operation is a conjugation operation (specification, page 28, lines 20 - 23) and therefore the examiner has interpreted the transformation operation to be a conjugation operation.

In the same field of endeavor, Alamouiti discloses a transformation that is performed on the input signal (page 1453, right column, 1st paragraph).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Alamouiti, in the system of Feuerstein because this would provide better performance than a system with no diversity, as disclosed by Alamouiti (page 1455, Fig. 4).

Regarding claim 3, Feuerstein discloses each transmit signal comprises a CDMA (Code Division Multiple Access) signal (Title; Abstract; column 12, lines 19 - 22).

Claim 33 is similarly analyzed as claim 2.

Claim 34 is similarly analyzed as claim 3.

10. Claim 4, 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Harrison (US 6.067,324), Alamouiti (A Simple Transmit Diversity Technique for Wireless Communications; October 1988; IEEE Journal on Select Areas in Communications; pages 1451 – 158).

Regarding claim 4, Feuerstein does not disclose that each main signal comprises a respective combined set of at least one code separated channel.

In the same field of endeavor, Lundby discloses each main signal comprises a respective combined set of at least one code separated channel (Fig. 2, elements 116, 118; column 6, lines 15 – 20; column 7, lines 18 – 21; wherein the code separated channel is interpreted as being obtained by the PN spreading code).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would separate a channel from other channels, thereby allowing detection of a channel on the receiver side, as is well known in the art.

Claim 35 is similarly analyzed as claim 4.

11. Claims 8, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Harrison (US 6.067,324).

Regarding claim 8, Feuerstein discloses the first linear combination comprises:

$$X_A(t) = \quad S_A(t) + \quad S_A(t - D1)$$

and the second linear combination comprises:

$$X_B(t) = \quad S_B(t) + \quad S_B(t - D2)$$

(Fig. 6, outputs of switch matrices 651, 652, 662, controller 670; column 7, lines 15 – 56; wherein the linear combinations are obtained by having the controller set the switch matrices appropriately).

and that a resulting channel matrix H yields a well conditioned H*H for a particular noise environment where D1 and D2 are delays and where H* is the complex conjugate of H (Abstract, column 1, lines 25 – 29; column 2, line 66 – column 3, line 13; It is well known to one of ordinary skill in the art that a well conditioned spectrum has no nulls while an ill-conditioned spectrum has deep nulls. Therefore, having a well-conditioned matrix is equivalent to avoiding deep nulls in the spectrum).

Feuerstein does not disclose the scale factors that are used for the linear combination.

In the same field of endeavor, however, Harrison discloses a scale factors that can be applied to each path (Fig. 5, element 306; column 6, lines 44 – 48).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Harrison, in the system of Feuerstein because this would allow the spectrum to be shaped, as is well known to one of ordinary skill in the art or also control the transmitted power, as disclosed by Harrison (column 3, lines 45 – 47).

Claim 9 is similarly analyzed as claim 8, with the controller again setting the switch matrices to give the appropriate linear combination.

12. Claims 12, 21 - 23, 27, 37, 38, 44, 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of McGuffin (US 4,217,586).

Regarding claim 12, Feuerstein does not disclose that the delay is selected so that there is enough separation between the scrambling codes in the main and delayed paths.

In the same field of endeavor, however, McGuffin discloses each delay implemented in one of the delay elements is selected to provide enough separation between the scrambling code and a version of the scrambling code delayed by the delay such that

the scrambling code and the scrambling code delayed by the delay are substantially orthogonal to each other (column 6, lines 49 – 53).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by McGuffin, in the system of Feuerstein because this would allow the two PN codes to be resolvable and uncorrelated, as disclosed by McGuffin.

Regarding claim 21, Feuerstein does not disclose less than N receive antennas.

In the same field of endeavor, however, Lundby discloses there are less than N receive antennas (Fig. 3, element 200; wherein less than N is interpreted a single antenna).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow a single antenna to be used, thereby simplifying receiver complexity.

Claim 22, 27, 37, 38, 44, 45 are similarly analyzed as claim 21.

Regarding claim 23, Feuerstein discloses that all signals are CDMA (Code Division Multiple Access) signals (Title; Abstract; column 12, lines 19 – 22).

13. Claims 5, 14, 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Applicant Admitted Prior Art (hereafter referred to as AAPA).

Regarding claim 5, Feuerstein does not disclose each transmit signal comprises atleast one code separated signal combined with one main signal.

Applicant had admitted in the specification (Fig. 2) that such signals are combined (see Fig. 2, inputs to element 526; specification, page 8, line 4+).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by AAPA, in the system of Feuerstein because this would allow multiple types of channel to be transmitted simultaneously, as disclosed by AAPA.

Regarding claim 14, Feuerstein discloses a CDMA system (Title; Abstract; column 12, lines 19 – 22).

Feuerstein does not disclose code-separated channels that are generic, user specific and are used for main signals.

Applicant had admitted in the specification (Fig. 2, element 501; specification, page 21, lines 3 – 4; page 8, lines 4 – 22) that the typical conventional CDMA transmitter has a respective first set of at least one channels which are generic to multiple users; a respective second set of at least one channels which are user specific; and a respective

third set of channels which are user specific and which function as one of said main signals.

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by AAPA, in the system of Feuerstein because this would allow multiple types of channel to be transmitted simultaneously, as disclosed by AAPA.

Regarding claim 41, Feuerstein does not disclose transmitting and receiving OFDM.

Applicant had shown in the specification (Fig. 3; specification, page 21, lines 5 - 6;) a conventional OFDM transmitter and receiver.

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by AAPA, in the system of Feuerstein because this would allow the benefits of OFDM, namely resistance to multipath, data rate adaptation to SNR etc to be taken advantage of.,

14. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of El-Gamal et al. (US 20020131516).

Regarding claim 15, Feuerstein does not disclose that the first and second main signals are OFDM signals.

In the same field of endeavor, however, El-Gamal discloses the first main signal and the second main signal are each OFDM (Orthogonal Frequency Division Modulation) signals (Fig. 2, element 211 207; page 3, paragraph 32, last 4 lines in particular; page 7, paragraph 78, 1st 4 line sin particular).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by El-Gamal, in the system of Feuerstein because this would allow antenna diversity to be used for an OFDM system.

15. Claims 16, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) and further in view of Lundby et al. (US 6,356,528), Harrison (US 6.067,324 and El-Gamal et al. (US 20020131516).

Regarding claim 16, Feuerstein discloses the first linear combination comprises:

$$X_A(t) = \quad S_A(t) + \quad S_A(t - D1)$$

and the second linear combination comprises:

$$X_B(t) = \quad S_B(t) + \quad S_B(t - D2)$$

(Fig. 6, outputs of switch matrices 651, 652, 662, controller 670; column 7, lines 15 – 56; wherein the linear combinations are obtained by having the controller set the switch matrices appropriately).

and that a resulting channel matrix H yields a well conditioned H*H for a particular noise environment where D1 and D2 are delays and where H* is the complex conjugate of H (Abstract, column 1, lines 25 – 29; column 2, line 66 – column 3, line 13; It is well known to one of ordinary skill in the art that a well conditioned spectrum has no nulls while an ill-conditioned spectrum has deep nulls. Therefore, having a well-conditioned matrix is equivalent to avoiding deep nulls in the spectrum).

Feuerstein does not disclose the scale factors that are used for the linear combination.

In the same field of endeavor, however, Harrison discloses a scale factors that can be applied to each path (Fig. 5, element 306; column 6, lines 44 – 48).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Harrison, in the system of Feuerstein because this would allow the spectrum to be shaped, as is well known to one of ordinary skill in the art or also control the transmitted power, as disclosed by Harrison (column 3, lines 45 – 47).

Claim 17 is similarly analyzed as claim 16.

Regarding claim 19, Feuerstein discloses there in no large notch in the spectrum (Abstract, column 1, lines 25 – 29; column 2, line 66 – column 3, line 13).

Feuerstein does not disclose the scaling factors.

In the same field of endeavor, however, Harrison discloses a gain scaling that can be applied to each path (Fig. 5, element 306; column 6, lines 44 – 48).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Harrison, in the system of Feuerstein because this would allow the spectrum to be shaped, as is well known to one of ordinary skill in the art or also control the transmitted power, as disclosed by Harrison (column 3, lines 45 – 47).

16. Claim 18, 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Applicant Admitted Prior Art (AAPA) and El-Gamal et al. (US 20020131516).

Regarding claim 18, Feuerstein does not disclose a forward error correction block, symbol mapping, demultiplexing, and IFFTs.

Applicant had admitted in the specification (Fig. 3, OFDM transmitter 100; specification, page 21, lines 5 – 6) that the prior art discloses a forward error correction block for performing forward error correction on an incoming bit stream to generate a coded bit stream (Fig. 3, channel coding 104);

a symbol mapping function for mapping the coded bit stream to a first modulation symbol stream (Fig. 3, symbol mapper 106);

a first IFFT (Inverse Fast Fourier Transform) function (Fig. 3, IFFT 110), first prefix adding function and first windowing filter (Fig. 3, element 114) adapted to process the second modulation symbol stream to generate the first main signal (Fig. 3, element 120);

a second IFFT (Inverse Fast Fourier Transform) function, second prefix adding function and second windowing filter adapted to process the third modulation symbol stream to generate the second main signal (the second IFFT and subsequent processing is same as disclosed for the first IFFT but is used on the second stream obtained from the demultiplexer).

AAPA does not disclose a demultiplexing function.

In the same field of endeavor, however, Lundby discloses a demultiplexing function adapted to divide the modulation symbol stream into second and third modulation symbol streams (Fig. 2, element 104; column 5, line 66 – column 6, line 3).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the signal to be transmitted by multiple antennas, as disclosed by Lundby (Fig. 2).

Claim 42 is similarly analyzed as claim 18.

17. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view McGuffin (US 4,217,586).

Regarding claim 20, Feuerstein discloses a signal transmitted over a wireless channel from a transmitter (Fig. 4);

, the N transmit signals collectively containing a plurality N of main signals (Fig. 6, elements α , β , γ) and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals (Fig. 6, outputs of elements 621, 622, 623; column 7, lines 15 – 40; wherein the delayed signals are the outputs of the delay elements 621, 622, 623 that are fed to elements 651, 652, 662 to produce the beams 1, 2 ..12), wherein each transmit signal comprises a combination of a respective main signal of the plurality of main signals and at least one respective delayed main signal of the N delayed main signals (Fig. 6, elements 651, 652, 662 outputs; column 7, lines 1 - 56, wherein the outputs are obtained by combining the main signal with the delayed signals, the combination being provided by the switch matrices and the transmit signals are the beams that are fed to the transmit antennas in Lundby's system).

Feuerstein does not disclose multiple transmit antennas, a receiver with atleast one antenna and receive processing circuitry.

In the same field of endeavor, however, Lundby discloses a plurality N of transmit antennas (Fig. 4; column 5, lines 19 – 40), wherein the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas (Fig. 1, 2).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

In the same field of endeavor, however, McGuffin discloses a receiver for receiving a signal transmitted over a wireless channel (Fig. 1) , the receiver comprising: at least one receive antenna (Fig. 1, elements 2a, 2b, ...2m), each receive antenna receiving a respective receive signal over the wireless channel from the transmitter; receive signal processing circuitry adapted to perform receive processing for each of the N main signals and each of the N delayed main signals (Fig. 1, elements 6a-m, 10a-m, 11a-m).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by McGuffin, in the system of Feuerstein because this would allow the signal to be received by multiple antennas, thereby improving the receiver performance through antenna diversity, as is well known in the art.

18. Claims 24, 25, 39, 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of McGuffin (US 4,217,586) and Easton (US 5,764,687).

Regarding claim 24, Feuerstein does not disclose a finger detector.

In the same field of endeavor, however, Easton discloses a finger detector configured to process each receive signal to identify multi-path components transmitted by each antenna, the multi-path components comprising at least one pair of multi-path components comprising a first multi-path component and a second multi-path component which is later than the first multi-path component by the delay introduced at the transmitter (Fig. 2, elements 12, 14; column 5, lines 16 – 26; wherein the finger detector is interpreted as the searcher that can detect any delay that is also introduced by the transmitter).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Easton, in the system of Feuerstein because this would allow multipath components to be detected, as is well known in the art.

Regarding claim 25, Feuerstein does not disclose that the receiver does dispreading and descrambling and an array processor.

In the same field of endeavor, however, Easton discloses the receive signal processing circuitry comprises de-scrambling and de-spreading functions which produce de-spread

signals for each multi-path component (Fig. 3, elements 100, 106; column 9, lines 38 – 45; column 12,lines 50 - 61), the receiver further comprising: a virtual array processor for performing combining of the de-spread signals (column 6, line 66 – column 7, line 14; column 22, lines 32 – 33; wherein the array processor is interpreted as being done by the digital signal processor).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Easton, in the system of Feuerstein because this would allow the channel to be properly decoded, as is well known in the art.

Claim 39 is similarly analyzed as claim 24.

Claim 40 is similarly analyzed as claim 25.

19. Claims 26 - 30, 43, 46 – 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of McGuffin (US 4,217,586) and Hilton (US 20030080890).

Regarding claim 26, Feuerstein discloses Feuerstein discloses a signal transmitted over a wireless channel (Fig. 4, Abstract);

N transmit signals (Fig. 6, elements beam1, beam 2, ...) wherein the transmit signals are the beams 1 ...12), the N transmit signals collectively containing a plurality N of

main signals (Fig. 6, elements α , β , γ) and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals (Fig. 6, outputs of elements 621, 622, 623; column 7, lines 15 – 40; wherein the delayed signals are the outputs of the delay elements 621, 622, 623 that are fed to elements 651, 652, 662 to produce the beams 1, 2 ..12), wherein each transmit signal comprises a combination of a respective main signal of the plurality of main signals and at least one respective delayed main signal of the N delayed main signals (Fig. 6, elements 651, 652, 662 outputs; column 7, lines 1 - 56, wherein the outputs are obtained by combining the main signal with the delayed signals, the combination being provided by the switch matrices).

Feuerstein does not disclose multiple transmit antennas, a receiver with atleast one antenna and receive processing circuitry, an over sampling ADC, and a MIMO decoder.

In the same field of endeavor, however, Lundby discloses a plurality N of transmit antennas (Fig. 4; column 5, lines 19 – 40), wherein the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas (Fig. 1, 2);

a MIMO (Multiple Input Multiple Output) decoder adapted to perform MIMO processing on the pre-combined signals (Fig. 3, elements 220 and 222; column 8, lines 22 – 34; wherein the MIMO decoder is interpreted as the combined elements 220 and 222, which receive the multiple and produce a single stream. Also see Response to Arguments above).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25) and the received signal to be decoded, as is well known in the art.

In the same field of endeavor, however, McGuffin discloses a receiver for receiving a signal transmitted over a wireless channel (Fig. 1), the receiver comprising: at least one receive antenna (Fig. 1, elements 2a, 2b, ...2m), each receive antenna receiving a respective receive signal over the wireless channel from the transmitter;

signal processing circuitry adapted to perform receive processing for each of the sample streams to produce pre-combined signals (Fig. 1, elements 6a-m, 10a-m, 11a –m);

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by McGuffin, in the system of Feuerstein because this would allow the signal to be received by multiple antennas, thereby improving the receiver performance through antenna diversity, as is well known in the art.

In the same field of endeavor, however, Hilton discloses each receive antenna, a respective over-sampling analog to digital converter which samples the respective receive signal and a respective sample selector adapted to produce a respective

plurality of sample streams (Fig. 3; paragraph 18. Another method: Fig. 2; paragraph 17; also see response to Arguments (2^{nd} last bullet).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Hilton, in the system of Feuerstein because this would reduce the effects of aliasing , as is well known in the art.

Regarding claim 27, Feuerstein does not disclose less than N receive antennas.

In the same field of endeavor, however, Lundby discloses there are less than N receive antennas (Fig. 3, element 200; wherein less than N is interpreted a single antenna).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow a single antenna to be used, thereby simplifying receiver complexity.

Claim 28 is similarly analyzed as claim 27.

Regarding claim 29, Feuerstein discloses each transmit signal comprises a main signal and N-1 delayed signals (Fig. 6, elements 611 – 651; wherein the delayed signals are generated by delay elements 621, 622, 623).

Feuerstein does not disclose that each over sampling converter performs N times over sampling

In the same field of endeavor, however, Hilton discloses each over-sampling analog to digital converter performs N times over-sampling (Fig. 2, element 220, 230; page 2, paragraph 17; wherein the N times over sampling is interpreted as two times over sampling).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Hilton, in the system of Feuerstein because this would allow would reduce the effects of aliasing, as is well known in the art.

Claim 30 is similarly analyzed as claim 29, with the ADC having two times over sampling to generate two streams.

Claim 43 is similarly analyzed as the corresponding limitation in claim 26.

Claim 46 is similarly analyzed as claim 29.

Claim 47 is similarly analyzed as claim 30.

Examiner is including a second rejection for claim 26, especially for the last limitation in which the MIMO decoder is rejected using Rudrapatna et al. (EP 1313246 A1).

20. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of

McGuffin (US 4,217,586), Hilton (US 20030080890) and Rudrapatna et al. (EP 1313246 A1).

Regarding claim 26, Feuerstein discloses Feuerstein discloses a signal transmitted over a wireless channel (Fig. 4, Abstract);

N transmit signals (Fig. 6, elements beam1, beam 2, ...) wherein the transmit signals are the beams 1 ...12), the N transmit signals collectively containing a plurality N of main signals (Fig. 6, elements α , β , γ) and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals (Fig. 6, outputs of elements 621, 622, 623; column 7, lines 15 – 40; wherein the delayed signals are the outputs of the delay elements 621, 622, 623 that are fed to elements 651, 652, 662 to produce the beams 1, 2 ..12), wherein each transmit signal comprises a combination of a respective main signal of the plurality of main signals and at least one respective delayed main signal of the N delayed main signals (Fig. 6, elements 651, 652, 662 outputs; column 7, lines 1 - 56, wherein the outputs are obtained by combining the main signal with the delayed signals, the combination being provided by the switch matrices).

Feuerstein does not disclose multiple transmit antennas, a receiver with atleast one antenna and receive processing circuitry, an over sampling ADC, and a MIMO decoder.

In the same field of endeavor, however, Lundby discloses a plurality N of transmit antennas (Fig. 4; column 5, lines 19 – 40), wherein the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas (Fig. 1, 2);

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

In the same field of endeavor, however, McGuffin discloses a receiver for receiving a signal transmitted over a wireless channel (Fig. 1), the receiver comprising: at least one receive antenna (Fig. 1, elements 2a, 2b, ...2m), each receive antenna receiving a respective receive signal over the wireless channel from the transmitter;

signal processing circuitry adapted to perform receive processing for each of the sample streams to produce pre-combined signals (Fig. 1, elements 6a-m, 10a-m, 11a –m);

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by McGuffin, in the system of Feuerstein because this would allow the signal to be received by multiple antennas, thereby improving the receiver performance through antenna diversity, as is well known in the art.

In the same field of endeavor, however, Hilton discloses each receive antenna, a respective over-sampling analog to digital converter which samples the respective receive signal and a respective sample selector adapted to produce a respective plurality of sample streams (Fig. 3; paragraph 18. Another method: Fig. 2; paragraph 17; also see response to Arguments (2nd last bullet).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Hilton, in the system of Feuerstein because this would reduce the effects of aliasing , as is well known in the art.

In the same field of endeavor, however, Rudrapatna discloses a MIMO (Multiple Input Multiple Output) decoder adapted to perform MIMO processing on the pre-combined signals (Fig. 2. element 20; Abstract; paragraph 12; Also see Response to Arguments above).

21. Claim 49 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Baker (US 20020173302).

Regarding claim 49, Feuerstein does not disclose a single receive antenna and producing two signals from the single received signal.

In the same field of endeavor, however, Lundby discloses at a single receive antenna, receiving over a wireless channel a received signal (Fig. 3, element 200).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of

Feuerstein because this would allow a single antenna to be used, thereby simplifying receiver complexity.

In the same field of endeavor, however, Baker discloses processing the received signal to produce at least two signals which are mathematically equivalent to two signals which would be received over two different receive antennas; processing the two signals as if they were received over two different antennas (page 4, paragraph 53; Fig. 4; wherein the processing as if received on two antenna is done as shown in Fig. 4).

Other Prior Art Cited

22. The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The following patents are cited to further show the state of the art with respect to antenna diversity techniques:

Raleigh et al. (US 6,144,711) discloses use of spatio-temporal processing for communication.

Raleigh (US 6,377,631) discloses a transmitter incorporating spatio-temporal processing.

Kelkar et al. (US 20020064246) discloses Spatial-temporal methods and systems for reception of non-line-of-sight communication signals.

Briley (US 6,456,610) discloses a TDM/TDMA wireless telecommunication system with electronic scanning antenna.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Adolf DSouza whose telephone number is 571-272-1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on 571-272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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